IN THE CLAIMS:

Please amend the claims as follows:

1. (Currently amended) A calibrating method for a heat treatment apparatus that includes a processing vessel for accommodating process objects therein, a plurality of heaters and a plurality of temperature sensors; that stores a thermal model for estimating temperature of the process objects in the processing vessel based on outputs of the temperature sensors; that estimates the temperature of the process objects in the processing vessel based on the outputs of the temperature sensors by using the thermal model; and that controls the heaters based on the estimated temperature, to perform a heat treatment to the process objects, wherein the thermal model has a function of estimating temperature of one of the heaters and temperature of the temperature sensors, said method comprising the steps of:

driving the heaters to heat an interior of the processing vessel;

~~measuring temperature in the processing vessel;~~ and

calibrating a part of the thermal model involving temperature estimation of said one of the heaters ~~by adding or subtracting a correction value to the estimated temperature so that the estimated value of the temperature substantially coincides with the actual measurement value of the temperature, upon comparison of the measured temperature in the processing vessel with temperature of the process objects estimated by using the thermal model,~~

~~wherein:~~

~~the thermal model has a function of estimating temperature of one of the heaters and temperatures of the temperature sensors; and~~

wherein the calibrating step includes the steps of:

determining a matrix [K1, K2 ….., Kn] expressing relationship between an amount of change in the temperature of said one of the heaters and amounts of change in the measured temperatures of the temperature sensors, wherein the matrix is determined so as to satisfy the expression

$$\Delta T = [K1, K2, \ldots, Kn] \cdot \begin{bmatrix} \Delta Ts1 \\ \Delta Ts2 \\ . \\ . \\ \Delta Tsn \end{bmatrix}$$

where ΔT is said amount of change in the temperature of said heaters and ΔTs1…., ΔTsn are said amounts of change in the measured temperatures of the respective temperature sensors;

determining a difference between an estimated temperature of one of the temperature sensors located closest to the said one of the heaters, as estimated by using the thermal model, and an actual temperature of said one of the temperature sensors measured by the same; and

calculating a the correction value ~~based on the relationship and the difference wherein the correction value is to be applied to the temperature model such that the estimated temperature of the said one of the heaters, as estimated by the thermal model, substantially coincides with the actual measurement value of the temperature, and thereby adapts the thermal model to the heat treatment apparatus~~ according to the following expression

$$\text{Correction value} = [K1, K2, \ldots, Kn] \cdot \begin{bmatrix} a1 \\ a2 \\ . \\ . \\ an \end{bmatrix}$$

wherein said difference is assigned to one of "a1", "a2",…"an" corresponding to said one of the temperature sensors located closest to said one of the heaters, while zero is assigned to the remainder of "a1", "a2,"…"an".

2-5. (Canceled)

6. (Currently amended) The calibrating method according to claim1, wherein said one of the heaters is disposed in the processing vessel ~~A calibrating method for a heat treatment apparatus that includes a processing vessel for accommodating process objects therein, a plurality of heaters and a plurality of temperature sensors; that stores a thermal model for estimating temperature of the process objects in the processing vessel based on outputs of the temperature sensors; that estimates the temperature of the process objects in the processing vessel based on the outputs of the temperature sensors by using the thermal model; and that controls the heaters based on the estimated temperature, to perform a heat treatment to the process objects, said method comprising the steps of:~~

~~driving the heaters to heat an interior of the processing vessel;~~

~~measuring temperature in the processing vessel; and~~

~~calibrating the thermal model by adding or subtracting a correction value to the estimated temperature so that an the estimated value of the temperature substantially coincides with the actual measurement value of the temperature, upon comparison of the measured temperature in the processing vessel with temperature of the process objects estimated by using the thermal model,~~

~~wherein:~~

~~the plurality of heaters include an inside heater arranged in the processing vessel;~~

~~the thermal model has a function of estimating temperature of the inside heater; and~~

~~the calibrating step includes the steps of~~

~~determining a relationship between an amount of change in the temperature of the inside heater and amounts of change in the measured temperatures of the temperature sensors;~~

~~determining a difference between an estimated temperature of one of the temperature sensors located closest to the inside heater, as estimated by using the thermal model, and an actual temperature of said one of the temperature sensors measured by the same; and~~

~~calculating a correction value based on the relationship and the difference, wherein the correction value is to be applied to the temperature model such that the estimated temperature of the inside heater, as estimated by the thermal model, substantially coincides with the actual measurement value of the temperature, and thereby adapts the thermal model to the heat treatment apparatus~~.

7. (Currently Amended) A calibrating method for a heat treatment apparatus that includes a processing vessel for accommodating, process objects therein, a plurality of heaters and a plurality of temperature sensors; that stores a thermal model for estimating temperature of the process objects in the processing vessel based on outputs of the temperature sensors; that estimates the temperature of the process objects in the processing vessel based on the outputs of the temperature sensors by using the thermal model; and that controls the heaters based on the estimated temperature, to perform a heat treatment to the process objects, wherein the plurality of heaters include first and second heaters arranged above and below the process objects in the processing vessel, respectively, and the thermal model has a function of estimating temperature of one of the heater and temperature of the temperature sensors, said method comprising the steps of:

driving the heaters to heat an interior of the processing vessel;

~~measuring temperature in the processing vessel;~~ and

calibrating parts of the thermal model involving temperature estimation of the first and second heaters ~~by adding or subtracting a correction value to the estimated temperature so that an the estimated value of the temperature substantially coincides with the actual measurement value of the temperature, upon comparison of the measured temperature in the processing vessel with temperature of the process objects estimated by using the thermal model,~~ by determining first and second correction values which are to be added or subtracted to or from estimated temperatures of the first and second heaters, respectively,

~~wherein:~~

~~the plurality of heaters includes first and second heaters are arranged above and below the process object in the processing vessel, respectively;~~

~~the thermal model has a function of estimating temperatures of the first and second heaters; and~~

wherein the calibrating step includes the steps of:

determining a matrix [Kt1, Kt2, … Ktn] expressing relationship between an amount of change in the temperature of the first heater and amounts of change in the measured temperatures of the temperature sensors, wherein the matrix is determined so as to satisfy the following expression

$$\Delta Tt = [Kt1, Kt2, \ldots, Ktn] \cdot \begin{bmatrix} \Delta Ts1 \\ \Delta Ts2 \\ . \\ . \\ \Delta Tsn \end{bmatrix}$$

where ΔTt is said amount of change in the temperature of the first heater and ΔTs1…., ΔTsn are said amounts of change in the measured temperatures of the respective temperature sensors;

determining a first difference between an estimated temperature of one of the temperature sensors located closest to the first heater, as estimated by using the thermal model, and an actual temperature of the temperature sensor closest to the first heater as measured by the temperature sensors located closest to the first heater;

calculating a the first correction value ~~based on the relationship and the difference, wherein the first correction value is to be applied to the temperature model such that the estimated temperature of the first heater, as estimated by the thermal model, substantially coincides with the actual measurement value of the temperature~~ according to the following expression

$$\text{Correction value} = [Kt1, Kt2, \ldots, Ktn] \bullet \begin{bmatrix} a1 \\ a2 \\ . \\ . \\ an \end{bmatrix}$$

wherein said first difference is assigned to one of "a1", "a2",…"an" corresponding to said one of the temperature sensors located closest to the first heater, while zero is assigned to the remainder of "a1", "a2,"…."an";

determining a matrix [Kb1, Kb2, …Kbn] expressing relationship between an amount of change in the temperature of the second heater and amounts of change in the measured temperatures of the temperature sensors, wherein the matrix is determined so as to satisfy the following expression

$$\Delta Tb = [Kb1, Kb2, \ldots, Kbn] \bullet \begin{bmatrix} \Delta Ts1 \\ \Delta Ts2 \\ . \\ . \\ \Delta Tsn \end{bmatrix}$$

where ΔTb is said amount of change in the temperature of the second heater and ΔTs1…., ΔTsn are said amounts of change in the measured temperatures of the respective temperature sensors;

determining a second difference between an estimated temperature of one of the temperature sensors located closest to the second heater, as estimated by using the thermal model, and an actual temperature of the temperature sensor closest to the second temperature sensor measured by the temperature sensor closest to the second temperature sensor; and

calculating a the second correction value ~~based on the relationship and the difference, wherein the second correction value is to be applied to the temperature model such that the estimated temperature of the second heater, as estimated by the thermal model, substantially coincides with the actual measurement value of the temperature, and thereby adapts the thermal~~

~~model to the heat treatment apparatus~~ according to the following expression

$$\text{Correction value} = [Kb1, Kb2, \ldots, Kbn] \cdot \begin{bmatrix} b1 \\ b2 \\ . \\ . \\ bn \end{bmatrix}$$

wherein said second difference is assigned to one of "b1", "b2",..."bn" corresponding to said one of the temperature sensors located closest to the second heater, while zero is assigned to the remainder of "b1", "b2,"...."bn".

8. (Canceled)

9. (Currently amended) A heat treatment apparatus comprising:

a processing vessel for accommodating process objects therein, a plurality of heaters and a plurality of temperature sensors; and

a controller that stores a thermal model for estimating temperature of the process objects in the processing vessel based on outputs of the temperature sensors; that estimates the temperature of the process objects in the processing vessel based on the outputs of the temperature sensors by using the thermal model; and that controls the heaters, based on the estimated temperature, to perform a heat treatment to the process objects, the controller including:

means for driving the heaters to heat an interior of the processing vessel;

~~means for measuring temperatures of the process objects in the processing vessel;~~ and

means for calibrating a part of the thermal model involving temperature estimation of one of the heaters ~~by adding or subtracting a correction value to the estimated temperature so that an~~

~~the estimated value of the temperature substantially coincides with the actual measurement value of the temperature, upon comparison of the measured temperature in the processing vessel with temperature of the process objects estimated by using the thermal model,~~ by determining a correction value which is to be added or subtracted to or from an estimated temperature of one of the heaters,

~~wherein:~~

~~the thermal model has a function of estimating temperature of one of the heaters and temperature of the temperature sensors; and~~

wherein the calibrating means is configured:

to determine a matrix [K1, K2, …, Kn] expressing relationship between an amount of change in the temperature of said one of the heaters and amounts of change in the measured temperatures of the temperature sensors, wherein the matrix is determined to satisfy the expression

$$\Delta T = [K1, K2, \ldots, Kn] \cdot \begin{bmatrix} \Delta Ts1 \\ \Delta Ts2 \\ . \\ . \\ \Delta Tsn \end{bmatrix}$$

where ΔT is said amount of change in the temperature of said heaters and ΔTs1…., ΔTsn are said amounts of change in the measured temperatures of the respective temperature sensors;

to determine a difference between an estimated temperature of one of the temperature sensors located closest to the said one of the heaters, as estimated by using the thermal model, and an actual temperature of the said one of the temperature sensors measured by the same; and

to calculate a correction value ~~based on the relationship and the difference wherein the correction value is to be applied to the temperature model such that the estimated temperature of the said one heater, as estimated by the thermal model, substantially coincides with the actual measurement value of the temperature, and thereby adapts the thermal model to the heat treatment apparatus~~ according to the following expression

Correction value= [Kt1, Kt2, …., Kn] $\bullet \begin{bmatrix} a1 \\ a2 \\ . \\ . \\ an \end{bmatrix}$

wherein said difference is assigned to one of "a1", "a2",…"an" corresponding to said one of the temperature sensors located closest to said one of the heaters, while zero is assigned to the remainder of "a1", "a2,"…"an".

10-20. (Canceled)

21. (Currently amended) The heat treatment apparatus according to claim 9, wherein said one of the heaters is disposed in the processing vessel ~~A heat treatment apparatus comprising:~~

~~a processing vessel for accommodating process objects therein, a plurality of heaters and a plurality of temperature sensors; and~~

~~a controller that stores a thermal model for estimating temperature of the process objects in the processing vessel based on outputs of the temperature sensors; that estimates the temperature of the process objects in the processing vessel based on the outputs of the temperature sensors by using the thermal model; and that controls the heaters based on the estimated temperature, to perform a heat treatment to the process objects, the controller including:~~

~~means for driving the heaters to heat an interior of the processing vessel;~~

~~means for measuring temperatures of the process objects in the processing vessel; and~~

~~means for calibrating the thermal model by adding or subtracting a correction value to the estimated temperature so that an the estimated value of the temperature substantially coincides with the actual measurement value of the temperature, upon comparison of the measured temperature in the processing vessel with temperature of the process objects estimated by using the thermal model,~~

~~wherein:~~

~~the plurality of heaters includes an inside heater arranged in the processing vessel;~~

~~the thermal model has a function of estimating temperature of the inside heater and temperatures of the temperature sensors; and~~

~~the calibrating means is configured:~~

~~to determine a relationship between an amount of change in the temperature of the inside heater and amounts of change in the measured temperatures of the temperature sensors;~~

~~to determine a difference between an estimated temperature of one of the temperature sensors located closest to the inside heater, as estimated by using the thermal model, and an actual temperature of said one of the temperature sensors measured by the same; and~~

~~to calculate a correction value based on the relationship and the difference wherein the correction value is to be applied to the temperature model such that the estimated temperature of the inside heater, as estimated by the thermal model, substantially coincides with the actual measurement value of the temperature, and thereby adapts the thermal model to the heat treatment apparatus~~.

22. (Currently amended) A heat treatment apparatus comprising:

a processing vessel for accommodating process objects therein, a plurality of heaters and a plurality of temperature sensors; and

a controller that stores a thermal model for estimating temperature of the process objects in the processing vessel based on outputs of the temperature sensors; that estimates the temperature of the process objects in the processing vessel based on the outputs of the temperature sensors by using the thermal model; and that controls the heaters, based on the estimated temperature, to perform a heat treatment to the process objects, the controller including:

means for driving the heaters to heat an interior of the processing vessel; and

~~means for measuring temperatures of the process objects in the processing vessel; and~~

means for calibrating a part of the thermal model involving temperature estimation of the first and second heaters ~~by adding or subtracting a correction +- value to the estimated temperature so that the estimated value of the temperature substantially coincides with the actual~~

~~measurement value of the temperature, upon comparison of the measured temperature in the processing vessel with the temperature of the process objects estimated by using the thermal model~~, by determining first and second correction values which are to be added or subtracted to or from estimated temperatures of the first and second heaters, respectively,

~~wherein:~~

~~the plurality of heaters includes first and second heaters arranged above and below the process objects in the processing vessel, respectively;~~

~~the thermal model has a function of estimating temperatures of the first and second heaters; and~~

wherein the controller is configured:

to determine a matrix [Kt1, Kt2, ..., Ktn] expressing relationship between an amount of change in the temperature of the first heater and amounts of change in the measured temperatures of the temperature sensors, wherein the matrix is determined so as to satisfy the following expression

$$\Delta Tt = [Kt1, Kt2, \ldots, Ktn] \cdot \begin{bmatrix} \Delta Ts1 \\ \Delta Ts2 \\ . \\ . \\ \Delta Tsn \end{bmatrix}$$

where ΔTt is said amount of change in the temperature of the first heater and ΔTs1 ...., ΔTsn are said amounts of change in the measured temperatures of the respective temperature sensors;

to determine a first difference between an estimated temperature of one of the temperature sensors located closest to the first heater, as estimated by using the thermal model, and an actual temperature of the temperature sensor closest to the first heater measured by the temperature sensor closest to the first heater;

to calculate [[a]] the first correction value ~~based on the relationship and the difference wherein the first correction value is to be applied to the temperature model such that the~~

~~estimated temperature of the first heater, as estimated by the thermal model, substantially coincides with the actual measurement value of the temperature~~ according to the following expression

$$\text{Correction value} = [Kt1, Kt2, \ldots, Ktn] \cdot \begin{bmatrix} a1 \\ a2 \\ . \\ . \\ an \end{bmatrix}$$

wherein said difference is assigned to one of "a1", "a2",…"an" corresponding to said one of the temperature sensors located closest to said one of the heaters, while zero is assigned to the remainder of "a1", "a2,"…"an";

to determine a matrix [Kb1, Kb2, …, Kbn] expressing relationship between an amount of change in the temperature o

f the second heater and amounts of change in the measured temperatures of the temperature sensors, wherein the matrix is determined to satisfy the following expression

$$\Delta Tb = [Kb1, Kb2, \ldots, Kbn] \cdot \begin{bmatrix} \Delta Ts1 \\ \Delta Ts2 \\ . \\ . \\ \Delta Tsn \end{bmatrix}$$

where ΔTb is said amount of change in the temperature of the second heater and ΔTs1…., ΔTsn are said amounts of change in the measured temperatures of the respective temperature sensors;

to determine a second difference between an estimated temperature of one of the temperature sensors located closest to the second heater, as estimated by using the thermal model, and an actual temperature of the temperature sensor closest to the second temperature sensor as measured by the temperature sensor closest to the second temperature sensor; and

to calculate [[a]] the second correction value ~~based on the relationship and the difference wherein the second correction value is to be applied to the temperature model such that the estimated temperature of the second heater, as estimated by the thermal model, substantially coincides with the actual measurement value of the temperature, and thereby adapts the thermal model to the heat treatment apparatus~~ according to the following expression

$$\text{Correction value} = [Kb1, Kb2, \ldots, Kbn] \cdot \begin{bmatrix} b1 \\ b2 \\ . \\ . \\ bn \end{bmatrix}$$

wherein said second difference is assigned to one of "b1", "b2",…"bn" corresponding to said one of the temperature sensors located closest to the second heater, while zero is assigned to the remainder of "b1", "b2,"…"bn".